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# *Comandra Blister Rust*

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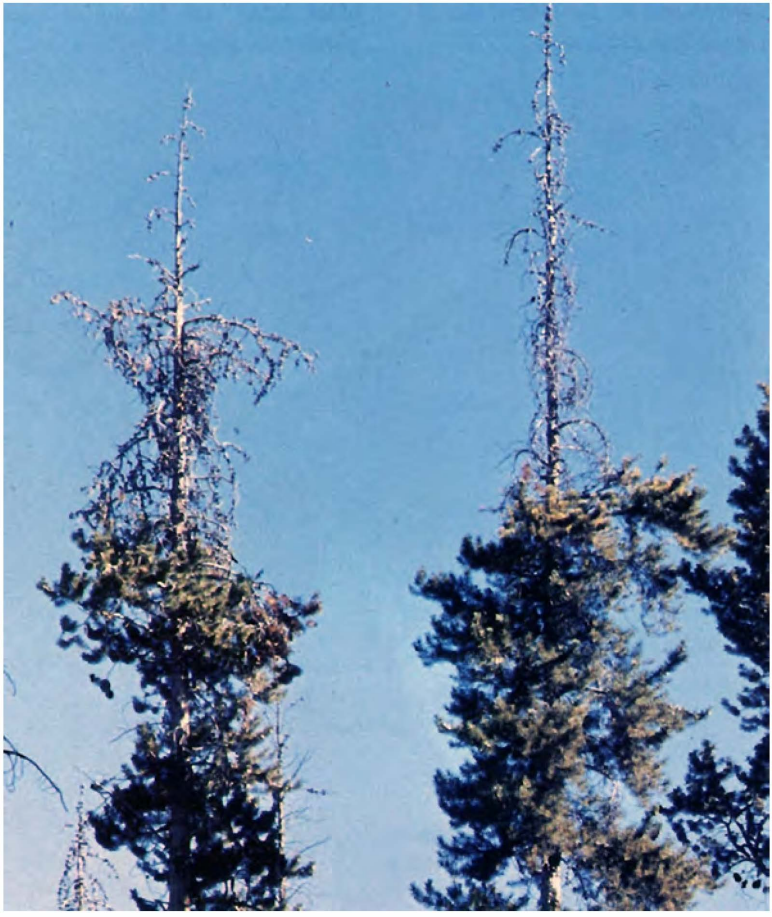

Comandra blister rust is a disease of hard pines that is caused by a fungus growing in the inner bark. The fungus (*Cronartium comandrae* Pk.) has a complex life cycle. It infects hard pines but needs an alternate host, an unrelated

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plant, to spread from one pine to another.

On hard pines, the fungus causes growth reduction, stem deformity, and mortality. In addition, pines with stem cankers produce significantly fewer cones and seeds than healthy trees.

The disease is most economically significant in the West. Widespread damage to lodgepole pine has been reported in Idaho, Montana, Utah, and Wyoming. In a 1981–82 survey of 27 randomly selected lodgepole pine stands in western Wyoming, half the basal area was infected and 85 percent of the infected trees had dead tops.

**Range and Hosts**

The disease has been found from New Brunswick west to the Yukon and British Columbia in Canada and south through the United States to California, New Mexico, and Alabama (fig. 1). The fungus, which is native to North America, has been reported on more than 30 species of hard pines. It has not been found in either Alaska or Mexico, although susceptible pine species grow in both places.

Comandra blister rust is most prevalent in the West, where its principal hosts are lodgepole pine and ponderosa pine.

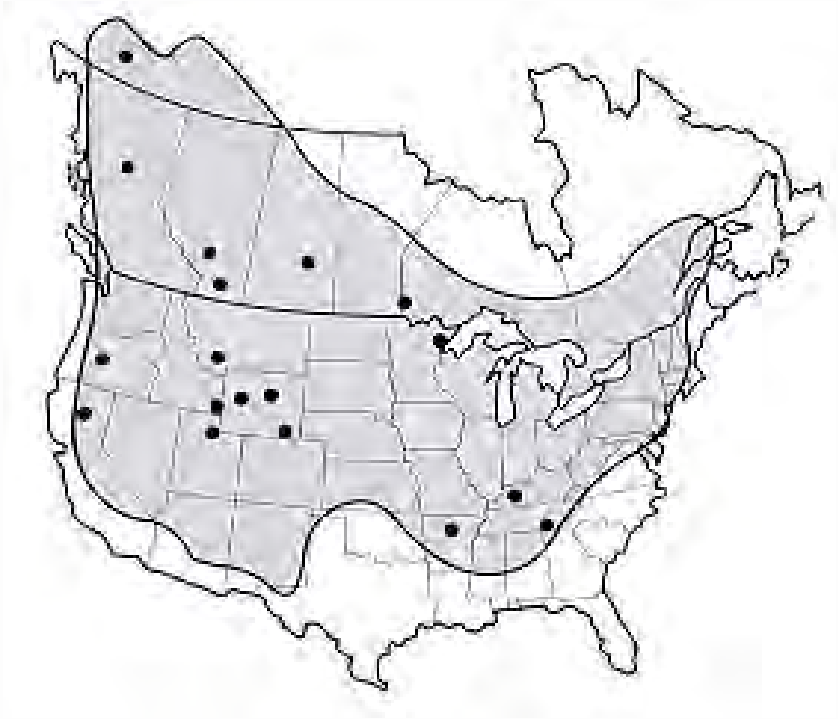


**Figure 1**—*Approximate range of* Cronartium comandrae. *Although the fungus is widespread, the disease is a management concern primarily in the West.*

In the North Central United States, the rust is found on jack pine, but usually only in trace amounts and in local areas.

Elsewhere, in the Northeast and the South, host trees include Table Mountain, loblolly, pitch, and shortleaf pines. Infected pines have been reported in Tennessee, Missouri, Arkansas, Alabama, and Kentucky. The incidence of the disease is scattered, however, and its damage is only occasionally of local importance. Its spread into the gulf coastal plain is restricted primarily by the absence of the alternate host in that area.

The alternate hosts, comandra or bastard-toadflax (*Comandra umbellata*) and northern comandra (*Geocaulon lividum*), are perennial herbs that parasitize the roots of associated plants. Comandra (fig. 2) commonly grows on dry, open rangelands adjacent to coniferous forests. Northern comandra occurs on wet sites in the Lake States and Canada.

**Figure 2**—*Comandra infected with the fungus.*

## Life Cycle and Spread

The fungus, an obligate parasite that develops only on living hosts, needs two types of hosts to survive. It grows perennially in the inner bark of hard pines and develops annually on the stems and leaves of herbaceous comandras. Like white pine blister rust, *Cronartium comandrae* cannot spread directly from pine to pine.

The fungus produces five types of spores: spermatia, aeciospores, urediniospores, teliospores, and basidiospores. The spermatia and the aeciospores are produced on hard pines; the others are produced on the alternate host (fig. 3).

Basidiospores from infected comandras are released from midsummer to early fall. Carried by the wind, these spores infect pine needles and shoots of hard pines. The fungus then spreads into the inner bark.

One to three years later, the first evidence of the disease appears: small drops of thick, sticky, reddish-orange liquid on the diseased bark. These drops contain spores called spermatia.

The following spring and summer, pustules form on the cankered areas that previously produced spermatia. These pustules soon rupture and release orange aeciospores. The teardrop shape of these spores distinguishes them from those of other rusts (fig. 4). Aeciospores—released during dry and warm, windy weather—infect comandras.

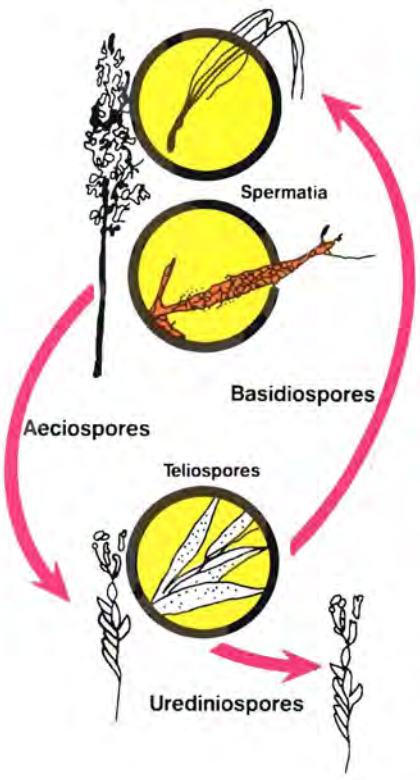


**Figure 3**—*Life cycle of* Cronartium comandrae. *It takes 3 to 5 years for the fungus to complete its life cycle. Only the aeciospores, urediniospores, and basidiospores are infective.*

**Figure 4**—*Characteristically teardrop-shaped aeciospores of* Cronartium comandrae.

Approximately 10 to 20 days after the comandras are infected, yellow blisterlike spots appear on their leaves. These spots produce yellow urediniospores, which infect other comandras. Several generations of the urediniospores may be produced in a single summer if moisture conditions are right.

About 3 weeks after the urediniospores appear, brown hairlike structures begin to develop on the comandras. These structures are composed of masses of teliospores.

In mild wet weather, the teliospores germinate and form basidiospores—the only spores of *Cronartium comandrae* that infect pines. These windborne spores are usually released at night or during periods of high humidity. Because the spores are small and delicate, they are unable to survive exposure to drying winds or high temperatures. When the basidiospores infect pines, the life cycle of the fungus begins again.

Fusiform rust, which is a serious problem in the South, has a similar life cycle, but that fungus produces lemon-yellow aeciospores. Fusiform cankers are also more obviously swollen than those caused by comandra blister rust.

## Damage

The rust attacks pines of all sizes and ages. Seedlings are the most susceptible and are usually killed within a few years by stem cankers. Infection of pole- and sawtimber-size trees results in growth loss and mortality that prevents those trees from becoming merchantable. It usually takes much longer to kill older pines: 50-year-old cankers have been found on recently killed trees.

The number of years it takes the fungus to girdle the main stem equals twice its diameter, in inches, at the spot where the canker occurs.

Most infections begin on the branches (fig. 5). The fungus can spread along a branch at a rate of 1 inch (2.5 cm) per year. If the branch dies before the fungus reaches the trunk, the fungus also dies. The farther a branch infection is from the trunk, the less chance that the fungus will reach the main stem, form a canker (fig. 6), and kill the pine.

**Symptoms**

Rodents are attracted to cankers and chew the spore-producing areas. Feeding rodents can gnaw away so much of the fungal area that they inactivate a canker (fig. 7). In other cases, their gnawing can girdle a tree and hasten its death.

Trunk infections in mature and overmature trees are accompanied by diagnostic crown symptoms. The first crown symptoms are dead branches in a narrow zone around the branch where the fungus entered the main stem (fig. 8). Above this zone, the crown thins and eventually dies, forming the characteristic spike tops. (See spike tops in cover photo.) These tops are resistant to decay and remain intact for many years.

As the fungus progresses down the stem, the uppermost branches die. If there is adequate foliage below the canker, large trees may survive; however, their growth is greatly reduced.

**Factors Affecting Outbreaks**

Cyclic epidemics of comandra blister rust may have occurred in the Western United States. Studies of cankers in the Rocky Mountains suggest that the rust has been endemic for over 100 years, increasing to epidemic levels from 1910 to 1945. Epidemics in the Rocky Mountains are thought to occur after slow, moist warm fronts pass during late summer. This type of weather provides optimum conditions for the dispersal of basidiospores. Generally, however, outbreaks are localized.

In the Southeast, the incidence of the disease and the amount of damage are closely correlated with the presence of the alternate host. There is no evidence that cyclic outbreaks similar to those

**Figure 5**—*Comandra blister rust canker on branch of lodgepole pine.*

**Figure 6**—*Canker on the main stem of a lodgepole pine. As the fungus girdles the stem, the abundant resin flow colors the affected portion yellow.*

that have occurred in the West have occurred in the Southeast.

## Control Recommendations

- Identify heavily infested stands, harvest as soon as management permits, and, if feasible, regenerate with tree species other than susceptible hard pines. Where seed trees are used to regenerate a stand, disease-free trees should be left as seed sources.
- Harvest merchantable trees with cankers on the lower or midportion of the stem before the fungus girdles the trees. Cankers occurring between the base of the trunk and a height of about 23 feet (7 m) are usually lethal.

**Figure 7**—*Signs of rodent-feeding on a lodgepole pine infected with a comandra rust canker.*

**Figure 8**—*Zone of dead branches in the crown, indicative of early decline. Spike top of tree on the right resulted from an earlier infection.*

• Prune infected branches. This technique is useful in preventing stem infections on high-value trees. Any branch canker within 9 inches (22 cm) of the stem should be pruned.

Other than retaining more trees than stocking guides recommend, no practical control measures are available to suppress the rust in young stands. Increased stocking will, over time, be offset by rust-caused mortality. In marginally stocked stands, the disease may cause significant losses.

Eradicating the alternate host is not practical. In the Southeast, stand management practices that reduce or avoid increasing the alternate host should be selected when regenerating a site with susceptible pines.

## Future of Rust Control

Recently, there has been interest in the purple mold *Tuberculina maxima* as a biological control agent. The mold restricts aeciospore production. In localized areas, it may grow in 70 percent of the active comandra blister rust cankers. This mold may eventually prove useful in control programs.

Because the rust is native and because some trees within a species are less susceptible than others, tree improvement programs to select resistant pines may be a successful approach.

## Assistance

Landowners can get more information about identification and control from a Cooperative Extension agent, the local State forestry office, or the Forest Pest Management staff, U.S. Department of Agriculture, Forest Service.

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